Synthesis of Carbon Nanotube-Titanium Dioxide Photocatalysts Via Modified Sol-Gel Method for Removal of Phenol

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ABSTRACT

In the present study, a series of carbon nanotube-titanium dioxide (CNT-TiO_2) has been successfully synthesized by a modified sol-gel method in the presence of acetyl acetone as the chelating ligand. X-ray diffraction (XRD), diffuse reflectance ultraviolet-visible spectroscopy (DR UV-Vis), Fourier transforms infrared spectroscopy (FTIR) and scanning electron microscope (SEM) were used to investigate the structural, optical properties and morphology of the sample. XRD patterns demonstrated that the addition of CNT maintained the anatase phase of TiO_2, while DR UV-Vis analysis showed the additional absorbance in the visible light region after addition of the CNT, suggesting the successful incorporation of CNT into TiO_2. The SEM image revealed the unaffected morphology of TiO_2 after addition of the CNT. The photocatalytic removal of phenol was carried out under UV light irradiation at room temperature for 24 hours. It was confirmed that all CNT-TiO_2 series showed better adsorption and photocatalytic activity than the TiO_2. The best photocatalyst was 5% CNT-TiO_2 with 68% of phenol removal, while TiO_2 showed only 17% phenol removal. Adsorption process was proposed to be one of the important factors for the high activity. It was concluded that the incorporation of CNT into TiO_2 using the modified sol-gel method would be a good alternative method to prepare highly active carbon based-TiO_2 photocatalysts.

| Phenol | TiO_2 | Carbon nanotube | CNT-TiO_2 | Adsorption | Photocatalysis |

Synthesize and Characterize Plasmonic Photocatalyst Ag/TiO_2 Supported on Stainless Steel Webnet

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ABSTRACT

Plasmonic nanostructures present substantial function in the advancement of modern materials science and technology. Plasmon-enhanced solar light is harvested to enhance the solar-to-fuel energy conversion efficiency. This has been among the most essential research topics over the last years, assisting to meet the rising global energy demand. Both organic and inorganic semiconductor materials often serve as photocatalysts for the direct conversion of solar energy into fuels, owing to their superior stability, environmental compatibility and photocatalytic activity. However, semiconductor efficiency can be hindered by their inability to absorb visible light due to the vast band gap. More recently, an abundance of research has been done to enhance photocatalyst and photovoltaic device efficiency by integrating plasmonic nanoparticles (NPs) with semiconductor materials. The presence of plasmonic NPs causes greater semiconductor absorption cross sections due to robust field enhancement, light absorption at longer wavelengths and enhanced electron–hole charge separation in semiconductor media, thus maximizing the efficiency of photocatalytic devices. In this study, we prepare new visible-light-driven plasmonic photocatalyst Ag/TiO_2 nanoparticles coated on webnet stainless steel were prepared by a simple and efficient method (dip-coating method) to enhance the visible light plasmonic photocatalyst. FESEM, EDX and UV–vis spectra analyses were carried out to characterize the prepared catalysts. The stainless steel webnet was selected as a photocatalyst support due to its large surface area that can provide more active sites for TiO_2 deposition than general supports and because it facilitates the best ventilation for passing gases.

| Plasmonic photocatalyst | Ag/TiO_2 | Webnet | Stainless steel |